

Calculations Using Engineering Prefixes

Calculation can be executed in NORMAL mode (excluding N-base) using the following 9 types of prefixes:

Prefix	Operation	Unit
k (kilo)	MATH $\times 10^3$	
M (Mega)	MATH $\times 10^6$	
G (Giga)	MATH $\times 10^9$	
T (Tera)	MATH $\times 10^{12}$	
M (milli)	MATH $\times 10^{-3}$	
m (micro)	MATH $\times 10^{-6}$	
n (nano)	MATH $\times 10^{-9}$	
p (pico)	MATH $\times 10^{-12}$	
f (femto)	MATH $\times 10^{-15}$	

Modifying Function

Decimal function results are internally obtained in scientific notation. The decimal function results and the calculation results are displayed in the form designated by the display notation and the number of decimal places indicated. The internal calculation result may differ from that displayed on the screen. By using the modify function (MATH \square), the internal value is converted to match that of the display, so that the displayed value can be used without change in subsequent operations.

When using the WritView editor, if the calculation result is displayed using fractions or irrational numbers, press (MATH \square) to convert it to decimal form first.

The modify function can be used in NORMAL, STAT, MATRIX, or LIST modes.

Simulation Calculation (ALGB)

If you have to find values consecutively using the same expression, such as plotting a curve for $2x^2 + 1$, or finding the variable values for $2x + 1 = 0$. In addition, you have to enter the expression, all you have to do is specify the value for the variable in the equation.

Usable variables: A-F, M, X and Y

• Simulation calculations can only be executed in NORMAL mode.

• Calculation ending instructions other than \square cannot be used.

Performing calculations

1. Press (MATH \square).

2. Input an expression with at least one variable.

3. Then press (MATH \square) to confirm. The calculation result will be displayed after you have entered a value for each variable used in the equation.

After completing the calculation, press (MATH \square) to perform calculations using the same equation.

• Variables and numerical values stored in the memories will be displayed in the variable entry screen. If you do not want to change any values, simply press (MATH \square).

• Performing simulation calculation will cause values in memory to be overwritten with new values.

Solver Function

The solver function finds the value for x that reduces the entered expression to zero.

• This function uses Newton's method to obtain an approximation depending on the function (e.g. periodic) or start value, an error may occur (ERROR 02) due to there being no convergence to the solution for the equation.

• The value obtained by this function may include a margin of error. If it is larger than acceptable, recalculate the solution after changing the "Start" and "dx" values.

• Change the "Start" value (e.g. to a negative value) or dx value (e.g. to a smaller value) if:

• no solution can be found (ERROR 02).

• no converging conditions appear to be possible (e.g. a cubic equation).

• to improve arithmetic precision.

• The calculation result is automatically stored in the X memory.

Press (MATH \square) to exit the solver function.

Performing solver function

1. Press (MATH \square).

2. Input an equation with an x variable.

3. Press (MATH \square).

4. Enter a "Start" value and press (MATH \square). The default value is "0".

5. Enter a "dx" value (minute interval).

6. Press (MATH \square).

LIST CALCULATIONS

You can store up to 100 lists in LIST mode. Up to 16 elements can be stored in each list.

Press (MATH \square) to enter LIST mode.

Note: You can use the MATRIZ menu in LIST mode to edit, recall, and store lists, as well as to call list-specific functions.

Entering and Storing Lists

Before performing list calculations, a list must be created.

Follow the steps below to enter and store lists.

1. Press (MATH \square) to enter LIST mode.

2. Press (MATH \square) to bring up the list entry screen.

Any list data remaining in the buffer, along with any previously entered, loaded, or calculated list data, will be displayed.

3. Define the list size (up to sixteen elements) by entering a value using the number keys and pressing (MATH \square).

The entry screen will display the list entry screen.

4. Enter each element in the list by entering a value in the entry field and pressing (MATH \square).

Each list item can display up to eight digits (the decimal point counts as one digit). If an element exceeds eight digits in length, it will be displayed in exponent notation within the list.

• A maximum of 100 lists can be displayed at one time. Use (MATH \square) and (MATH \square) to move the cursor through the list.

5. When you have entered a value for each element, press (MATH \square) to exit the list entry screen.

6. Press (MATH \square) and select a memory (L1-L4) to store the newly-created list.

Modifying a stored list

To load a stored list into the list entry screen, press (MATH \square), then select the memory (L1-L4) that holds the list you wish to modify.

• Loading new data into the screen will automatically replace any data that may already exist.

• You can modify the values of elements in the list. Assign new values whenever necessary and press (MATH \square) after each one.

• If you wish to modify the size of a list, first press (MATH \square).

You can then enter new values for the list size.

3. When you have finished making changes, press (MATH \square) to exit the list entry screen.

4. Press (MATH \square) and select a memory (L1-L4) to store the newly-created list.

Using Lists in Calculations

Lists stored in memory (L1-L4) can be used in arithmetic calculations and calculations that use x^2 , y^2 , and x^y . You can also use the following list-specific functions that are available in the MATH menu.

sort(L1, L2) Sorts list 1 in ascending order.

sort(L1, L2) Sorts list in descending order.

dim(L1, n, size) Returns n with size changed as specified.

fit(L1, size) Enters the specified value for all items.

sort(L1, L2) Sequentially cumulates each item in the list.

sort(L1, L2) Returns the average of the range between adjacent items in the list.

aug(L1, n, listname) Returns a list holding the specified lists.

min(L1) Returns the minimum value in the list.

max(L1) Returns the maximum value in the list.

mean(L1) Returns the mean value of items in the list.

median(L1) Returns the median value of items in the list.

prod(L1) Returns the multiplication of items in the list.

stddev(L1) Returns the standard deviation of items in the list.

var(L1) Returns the variance of the list.

lprod(L1, listname) Returns the outer product of 2 lists (vectors).

lprod(L1, listname) Returns the inner product of 2 lists (vectors).

abs(L1) Returns the absolute value of the list vector.

mat(L1, n, m) Creates matrix with n column data from list 1 and m column data from list 2.

mat(L1, n, m) Matrices changes from LIST mode to MATRIX mode.

Notes:

• When the matrix entry screen is displayed, you cannot perform list calculations because the MATH menu is not available.

• If the calculation result is a matrix, it will be displayed in the matrix entry screen (note that this replaces any existing data in the buffer). To store the calculation result, first press (MATH \square) to exit the matrix entry screen. Press (MATH \square) and select a memory (matrix-mat) to store the newly-created matrix.

• When the calculation results are in matrix form, pressing neither (nor \square) will bring you back to the original expression.

EQUATION SOLVERS

The results obtained by these functions may include a margin of error.

Simultaneous Linear Equations

Simultaneous linear equations with two unknowns (2-VLE) and with three unknowns (3-VLE) may be solved using the following functions.

1. 2-VLE: (MATH \square \square \square \square)

$$\begin{cases} a_1x + b_1y = c_1 \\ a_2x + b_2y = c_2 \end{cases}$$

| $a_1, b_1, c_1, a_2, b_2, c_2$ |

2. 3-VLE: (MATH \square \square \square \square)

$$\begin{cases} a_1x + b_1y + c_1z = d_1 \\ a_2x + b_2y + c_2z = d_2 \\ a_3x + b_3y + c_3z = d_3 \end{cases}$$

| $a_1, b_1, c_1, d_1, a_2, b_2, c_2, d_2, a_3, b_3, c_3, d_3$ |

• If the simultaneous value is 0, an error occurs.

• If the absolute value of an intermediate result or calculation result is 1×10^{10} or more, an error occurs.

Solving simultaneous linear equations

1. Press (MATH \square \square \square \square) or (MATH \square \square \square \square)

• Coefficients can be entered using ordinary arithmetic operations.

• To clear the entered coefficient, press (MATH \square).

• Press (MATH \square) or (MATH \square) to move the cursor up or down through the coefficients. Press (MATH \square) or (MATH \square) to jump to the first or last coefficient.

3. When all coefficients have been entered, press (MATH \square) to solve the equation.

• While the solution is displayed, press (MATH \square) or (MATH \square) to return to the coefficient entry display. To clear all the coefficients, press (MATH \square).

4. Press (MATH \square) and select a memory (L1-L4) to store the newly-created list.

STATISTICAL CALCULATIONS

Statistical calculations can be performed in STAT mode.

There are eight sub-modes within STAT mode. Press (MATH \square) then press the number key that corresponds to your choice:

1. (STAT 1 [S]): Single-variable statistics

2. (STAT 2 [Q]): Linear regression

3. (STAT 3 [C]): Quadratic regression

4. (STAT 4 [L]): Logarithmic regression

5. (STAT 5 [P]): Power regression

6. (STAT 6 [INV]): Inverse regression

7. (STAT 7 [E]): General exponential regression

Statistical Calculations and Variables

The following table provides details for each statistical calculation (refer to the table below):

Single-variable statistical calculation

Statistics of \bar{x} and s of the normal probability function.

Linear regression calculation

Statistics of \bar{x} and \bar{y} : In addition, the estimate of y for a given x (estimate \hat{y}) and the estimate of x for a given y (estimate \hat{x}).

Quadratic regression calculation

Statistics of \bar{x} and \bar{y} : In addition, the quadratic regression calculation, no correlation coefficient (r) can be obtained.

When there are two x values, each value will be displayed with " 1 " or " 2 ", stored separately in X_1 and X_2 memories.

Logarithmic regression calculation

Statistics of \bar{x} and \bar{y} : In addition, the logarithmic regression calculation, no correlation coefficient (r) can be obtained.

Power regression calculation

Statistics of \bar{x} and \bar{y} : In addition, the power regression calculation, no correlation coefficient (r) can be obtained.

Inverse regression calculation

Statistics of \bar{x} and \bar{y} : In addition, the inverse regression calculation, no correlation coefficient (r) can be obtained.

General exponential regression calculation

Statistics of \bar{x} and \bar{y} : In addition, the general exponential regression calculation, no correlation coefficient (r) can be obtained.

Data correction

Correction before pressing (DATA) immediately after a data entry.

Deletes incorrect data with (DATA) then enter the correct data.

Data entry after pressing (DATA)

Use (DATA) and (DATA) to display the previously entered data set.

Press (DATA) to display the data set in ascending (oldest first) order. To reverse the display order to descending (latest first), press the (DATA) key. Press (DATA) or (DATA) or (DATA) to jump to the cursor to the beginning or end of the data set.

Each data set is displayed with "X", "Y", or "F".

Statistical Calculation Formulas

Type

Regression formula

$y = a + bx$

$y = a + bx + cx^2$

$y = a \cdot e^{bx}$

$y = a + b \ln x$

$y = a \cdot x^b$

$y = a + b/x$

$y = a + b \cdot 10^x$

$y = a + b \cdot 10^{-x}$

$y = a + b \cdot e^{cx}$

$y = a + b \cdot \ln x$

$y = a + b \cdot x^c$

$y = a + b \cdot 10^{cx}$

$y = a + b \cdot e^{cx}$

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